

## Unit 6 - Week 04: Tapestry Routing Protocol, Multi-dimensional Distributed Hash Table, and Multi-Layer DHT

Course outline
How does an NPTEL online course work?
Week 0
Week 01: P2P Networks – Motivation, Basics – Cryptographic Hash, Public Key Cryptography Principles, Security Certificates, Structured and Unstructured P2P Networks, Inconsistent Hashing, Consistent Hashing, Rendezvous Hashing, Locality Preserving Hashing, Distributed Hash Tables
Week 02: Logarithmic Partitioning of Node ID Space and Index Entry Authenticity, Implementation of Voice Over Internet Telephony in P2P Way, Leaf node, Core node and Type of Messages in DHT Networks, Static and Dynamic Partitioning of Node ID Space: Fixed and floating partitioning
Week 03: DHT Routing Protocol : Pastry and Kademlia
Week 04: Tapestry Routing Protocol, Multi-dimensional Distributed Hash Table, and Multi-Layer DHT
<input type="radio"/> Lecture 11: Tapestry: An Evolution of Kademlia
<input checked="" type="radio"/> Lecture 12: Understanding the Tapestry Protocol through Example
<input checked="" type="radio"/> Lecture 13: Multi dimensional Distributed Hash Table: Mapping of Peers into Multidimensional Space
<input type="radio"/> Lecture 14: Multi Layer DHT: A Design for Multiple Services
<input type="radio"/> Quiz : Assignment_4
<input type="radio"/> Feedback For Week 4
<input checked="" type="radio"/> Solution: Assignment-04
<input type="radio"/> New Lesson
Week 05: Keeping <Key, Value> Pairs at Correct Root Nodes, Abrupt and Graceful Exit of Root Node, Resilience of <Key, Value> Pairs, Distributed File System, Storage Space Problem and Incentives to Share Storage
Week 06: P2P Nodes Communications Challenges in Heterogeneous Network Environments, P2P Overlaid Multicast, and A Design of P2P Email System
Week 07: P2P Mailing List Services, P2P Web, P2P Search Engine, On Being Anonymous and P2P in Blockchain
Week 08: P2P Anonymous Communication, The Anonymous Communication on the Internet through TOR Network, An Introduction to TOR Browser, Hidden Services on TOR Network, and Summary of the Course
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### Assignment\_4

The due date for submitting this assignment has passed.  
As per our records you have not submitted this assignment.

**Due on 2020-10-14, 23:59 IST.**

- 1) Consider the following statements about the multi-layer network concept. 1 point
- The multi-layer network can be modeled using a multi-graph.
  - A simple graph represents the single-layer network.
  - If a multi-layer DHT network represented by set of layers to which a node is member. The required number of multi-sets need NOT be equal to number of nodes.
  - A node who is not part of a layer, can be a leaf node for the DHT network represented by the layer.

Which of the above statement/s is/are **NOT** true? Select the correct code.

- i only  
 i, ii  
 iii only  
 iii, iv

No, the answer is incorrect.  
Score: 0  
Accepted Answers:  
iii only

- 2) Consider the following statements about the root node. 1 point
- For any object, there will be unique responsible node called as root node.
  - The root node stores either the object or the references to the nodes that store the object.
  - Tapestry is decentralized and the root node for an object can be the current node itself, even if better matching node can be found to whom the entry can be forwarded.
  - In Kademlia, a root node for an object is chosen to be the one with hash value that shares the most prefix digits with the object's hash value.

Which of the above statement/s is/are **NOT** true? Select the correct code.

- i only  
 ii, iv  
 iii only  
 iv only

No, the answer is incorrect.  
Score: 0  
Accepted Answers:  
iii only

- 3) Suppose a Tapestry network contains only the nodes 583f, 70d1, 70f5, and 70fa. The root node for an object with a hash of 60f4 is 1 point

- 70f5  
 70fa  
 583f  
 None of the above

No, the answer is incorrect.  
Score: 0  
Accepted Answers:  
70f5

- 4) Consider the following statements about the routing table of the Tapestry. 1 point
- In order to allow nodes to locate objects stored at other nodes, each node maintains a routing table.
  - For creating the routing table, a node creates  $k$  partitions in node ID space at highest level and maintain  $k-1$  entries, one each form other partitions. At next level, the current partition of the node is further partitioned in  $k$  sub-partitions, and node maintains  $k-1$  node IDs, one each from other sub-partitions. This is followed, till the smallest subsub...partition has  $N$  nodes only.
  - In a Tapestry mesh that uses 40-digit IDs, the routing table would thus have 40 levels. The level represents the size of the shared prefix with the local node; that is, a node on level  $n$  of the routing table shares a prefix of length  $n-1$  with the local node.
  - Each level of the table consists of several entries, one for each unique digit at that level. In a tapestry with Octal digits, each level of the routing table has 16 slots.

Which of the above is statement/s is/are **NOT** correct? Select the correct code.

- i only  
 ii, iv  
 iii only  
 i, iii

No, the answer is incorrect.  
Score: 0  
Accepted Answers:  
ii, iv

- 5) Failures can occur due to server outages (those due to high load and hardware/software failures), link failures (router hardware and software faults), neighbor table corruption at the server, and failure of intermediate nodes. Consider the following statements about possible modifications to Tapestry to make it fault-tolerant. 1 point
- Each entry table has two backup-IDs (backup neighbors) apart from the primary neighbor.
  - The primary and backup IDs are chosen based on RTT (Round Trip Time) to the neighbors.
  - Whenever the primary ID fails, the backup ID's are initiated, and a stream of control, messages are passed to the failed primary neighbor to see if it is repaired.
  - If the primary is repaired, then it is re-initiated.
  - If the failed node is not repaired within a timeout interval, then the Secondary Neighbor is made primary, and a new secondary node is brought in.

Which of the above is statement/s is/are correct? Select the correct code.

- i only  
 ii, iv  
 iii only  
 All of the above

No, the answer is incorrect.  
Score: 0  
Accepted Answers:  
All of the above

- 6) Consider the Root finding algorithm in Tapestry. The steps are given as follows: 1 point
- Step 1: Compute Hash(Object ID) = Hash ID.  
Step 2: If most significant  $k-1$  digits are matching with current node ID, go to routing table's  $k$ th column. In  $k$ th column, find the node, which has  $k$ th digit greater than or equal to  $k$ th digit of HashID.  
Step 3: If the found node is not the current node, then handover the query to found node.  
Step 4: If the found node is current node or no node is found, then move to  $k+1$ st column and repeat step 2. If no more column are there to check, then the current node is root node.  
Step 5: If current node is repeatedly identified as root node, the root node does not exist.

Which of the step/s is/are **NOT** correct? Select the correct code.

- Step 1  
 Step 2, 3  
 Step 3, 4  
 Step 5

No, the answer is incorrect.  
Score: 0  
Accepted Answers:  
Step 5

- 7) Consider the following statements about Multi-layered networks. 1 point
- Multi-layered networks consist of layers of several networks, where nodes appear in at least one of these layers.
  - The networks are both connected by intra-layer links (links in one layer) as well as inter-layer links (links between layers which is not an actual link but a common node across the layers).
  - In real communication networks, such as a peer-to-peer network, one can draw a logical network (the connectedness of peers with each other) as well as a physical network (the way peers are connected through cables, hubs and data centers).
  - Single layer networks are mostly a simplification of the real-world. Each network layer has nodes which are related by some common property to each other.

Which of the above is statement/s is/are correct? Select the correct code.

- i, ii  
 iii only  
 iv only  
 All of the above

No, the answer is incorrect.  
Score: 0  
Accepted Answers:  
All of the above